

Serial No. 10/565,949

Atty. Doc. No. 2003P08308WOUS

REMARKS

This paper is responsive to the Office Action mailed April 9, 2007. Claims 12-29 remain in the application. All of the claims were rejected under Section 102 based on the Yoshida reference (US 6,708,668). Applicants respectfully request reconsideration of the claims in view of the following argument.

As presented, respectively, in the independent claims 12, 23 and 27, the invention is directed to a method, an apparatus and a system for controlling transition between a normal operation mode and a cut-off operation mode in an engine. The claimed invention differs from the applied prior art because it is directed to controlling transitions in relation to a cut-off operation mode, while the Yoshida reference only appears directed to modification of a fuel mixture for "activation of a catalytic converter by elevating the exhaust gas temperature ..." See Col. 1, lines 19-21. This is confirmed by the flowcharts of figures 6 and 7 which each require, initially, a determination as to "whether stratified stoichiometric combustion is permitted." See Col. 7, lines 66-67. In particular, the reference appears to only concern provision of a control system that can "maximize the catalyst activation effect by the stratified stoichiometric combustion." See Col. 2, lines 27-32. As explained in the Yoshida reference, in an engine adapted to use stratified stoichiometric combustion "when there is a demand for elevating an exhaust gas temperature, homogeneous combustion is used at cold start ... [but then] the ... stratified stoichiometric combustion is used to meet with the demand for elevating the exhaust gas temperature." After the catalytic converter has been activated, the combustion mode is switched to homogeneous lean combustion." See Col. 1, lines 46-59.

From the foregoing it is apparent that the Yoshida reference is concerned with bringing an engine from cold start into normal operation, i.e., promoting activation of a catalytic converter by elevating the exhaust gas temperature. On the other hand, applicants' claims are directed to the transitioning of an engine between a normal operation mode and a fuel cut-off operation mode. These are two different problems which each may, in part, be addressed with a change in ignition timing. However, the methods of each are different and are not interchangeable.

Specifically, the Yoshida reference does not recognize the problem which the applicants address and the solution which the Yoshida reference presents is not the same as that presented in any of the independent claims 12, 23 and 27. This is more fully explained below with respect

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to each independent claim. However, the applicants first note a potential source of confusion with the prior art that may have resulted in application of the Yoshida reference.

The Examiner may have observed that the Yoshida reference is concerned with suppressing

“a sudden and sharp variation of torque [at the time of] switching from a homogeneous combustion to a stratified stoichiometric combustion” by “advancing the ignition timing ... simultaneously with the switching of the combustion mode ...” See Col. 2, lines 1-14.

This switching of the combustion mode disclosed by Yoshida is different than and inconsistent with what is taught and claimed by the applicants. The prior art involves advancing an ignition timing at a time of “switching form the homogeneous mode to the stratified stoichiometric combustion mode. See Col. 2, lines 1 – 14. This advancing of timing is “by an amount for offsetting a variation of torque ... with the switching of the combustion mode.” This is inconsistent with the invention of claim 1 which requires “adjusting an ignition angle in a retarded direction in order to reduce a torque jump ...[Emphasis Added]” On the other hand, the invention is more that merely adjusting an ignition angle in a retarded direction. The prior art fails to teach or suggest the feature in claim 12 of “adjusting an ignition angle in a retarded ignition direction in order to reduce a torque jump ...”

As noted above, this feature must be seen as different from the Yoshida reference which addresses advancing an ignition timing “by an amount for offsetting a variation of torque ... with the switching of the combustion mode.” Thus, while the prior art addresses “torque jump” it is not addressed according to the method of claim 1 and such “torque jump” which is of concern in the Yoshida reference does not result from transitioning of an engine between a normal operation mode and a fuel cut-off operation mode.

The method of claim 12 is different and non-obvious over the Yoshida reference because it concerns controlling and reducing a torque jump in “the transition between a normal operation mode of a direct fuel injected Otto engine and an overrun fuel cut-off operation mode of the engine” by “adjusting an ignition angle in a retarded ignition direction ...” The Yoshida reference does not teach or suggest such a method. None of the prior art suggests applicants’ combination of these features which include

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“injecting fuel into a cylinder of the engine in the form of multiple injections, wherein a quantity of the injected fuel is injected into the engine during a compression phase of the Otto engine cycle.”

There is no teaching in the prior art which can result in the combination set forth in claim 12.

The engine mode switchover apparatus of claim 23 is also allowable over the art of record. The claimed apparatus is distinguished because it results in control of the transition between a normal operation mode of an Otto engine and an overrun fuel cut-off operation mode of the engine and a return to the normal operation mode of the engine. Accordingly, the combination of features includes a “control program adapted to reduce the ignition angle and subsequently inject the fuel into the cylinder during the compression phase of the engine.” The Yoshida reference does not disclose such a combination to control “transition between a normal operation mode of an Otto engine and an overrun fuel cut-off operation mode of the engine and a return to the normal operation mode of the engine”

For similar reasons, the engine management system of claim 27 is non-obvious over the prior art, requiring control of “the transition between a normal operation mode of an Otto engine and an overrun fuel cut-off operation mode of the engine and return to the normal operation mode of the engine ...” The claimed system is distinguished because the combination of features includes

“a device for adjusting ... an intake air mass of the engine; and ... a control program ... adapted to reduce the ignition angle and subsequently inject the fuel into the cylinder during the compression phase of the engine [Emphasis Added].”

It is also submitted that the dependent claims further distinguish over the prior art. By way of example, the method of claim 15 further requires that “an engine intake air mass is reduced and then the ignition angle is decreased to a first minimum value which is predetermined for a reduced-air operating mode.” There is no basis for rejecting this claim based on the Yoshida reference.

As another example, the method of claim 19 requires that “the ignition angle is decreased to a second minimum value that is less than the first minimum value ...” and that “after the second minimum value has been attained, the fuel injection is cut off and the engine

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operation mode is switched from the normal operation mode to the overrun fuel cut-off operation mode." Again, there is no combination in the prior art which can result in the claimed subject matter.

Still another distinguishing feature in relation to controlling "the transition between a normal operation mode ... and an overrun fuel cut-off operation mode ..." is that of having the fuel "injected in a plurality of small quantities" as required by claims 23 and 28.

Conclusion

For multiple reasons it has been shown that the claims cannot be rejected based on the Yoshida reference whether applied alone or in combination with other prior art. That is, the disclosure of the Yoshida reference is inconsistent with the claimed subject matter and the system disclosed by the Yoshida reference would have to be reconstructed to meet the terms of applicants' claims. There is no teaching in the prior art for any such reconstruction.

In view of the foregoing the Examiner is requested to allow the claims and pass this application to issuance. The commissioner is hereby authorized to charge any appropriate fees due in connection with this paper, or credit any overpayments to Deposit Account No. 19-2179.

Respectfully submitted,

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